Claims

What is claimed is:

1. A carrier electrical circuit conditioning assembly comprising:

at least one differential and common mode filter having at least a first and second differential electrode band and at least one common ground conductive band;

a conductive ground surface electrically connected to said at least one common ground conductive band; and

at least two signal conductors electrically connected between said first and second differential electrode bands with both of said at least two signal conductors electrically isolated from one another and from said common ground conductive band;

wherein said at least one differential and common mode filter provides at least one capacitive element electrically connected between said at least two signal conductors;

wherein said at least one differential and common mode filter provides at least two capacitive elements, one electrically connected between said first signal conductor and said ground conductive surface and the other electrically connected between said second signal conductor and said ground conductive surface; and

wherein said at least one differential and common mode filter provides electrical isolation between said at least two signal conductors.

2. A carrier electrical circuit conditioning assembly as recited in claim 1, wherein said conductive ground surface in combination with said differential and common mode filter minimizes the effects of stray capacitance thereby decreasing the level of electrical noise coupled onto said at least two signal conductors.

3. A carrier electrical circuit conditioning assembly as recited in claim 1, wherein said conductive ground surface in combination with said differential and common mode filter increases the attenuation and filtering provided by said at least one differential and common mode filter.

4. A carrier electrical circuit conditioning assembly as recited in claim 1, wherein said conductive ground surface in combination with said differential and common mode filter increases decoupling efficiency to said signal conductors provided by said at least one differential and common mode filter thereby reducing the level of switching noise coupled onto said at least two signal conductors.

5. A carrier electrical circuit conditioning assembly as recited in claim 1, wherein said conductive ground surface in combination with said differential and common mode filter increases the mutual cancellation of magnetic fields generated between said at least two signal conductors.

6. A carrier electrical circuit conditioning assembly as recited in claim 1, wherein said conductive ground surface in combination with said differential and common mode filter decreases the level of mutual inductive coupling between said at least two signal conductors.

7. A carrier electrical circuit conditioning assembly as recited in claim 1, wherein said conductive ground surface in combination with said differential and common mode filter minimizes the effects of cross talk between said at least two signal conductors.

8. A carrier electrical circuit conditioning assembly as recited in claim 1, wherein said conductive ground surface in combination with said differential and common mode filter minimizes the effects of ground return loops coupled onto said at least two signal conductors.

9. A carrier for a surface mount differential and common mode filter, wherein said surface mount differential and common mode filter includes first and second electrode bands and at least one common ground conductive band, comprising:

an planar insulator having at least two apertures disposed therein;

a conductive ground surface partially spanning the area of said planar insulator;

at least two conductive pads formed on a first side of said planar insulator, wherein each of said at least two apertures are surrounded by one of said at least two conductive pads; and

at least two insulating bands disposed on said planar insulator, wherein each of said at least two conductive pads is electrically isolated from said conductive ground surface by one of said at least two insulating bands;

wherein said surface mount differential and common mode filter is placed upon said carrier so that said first and second electrode bands are electrically connected to said at least two conductive pads and said common ground conductive band is electrically connected to said conductive ground surface.

10. A carrier for a surface mount differential and common mode filter as recited in claim 9, wherein the inner walls of each of said at least two apertures includes conductive plating which is electrically connected to said each of said corresponding at least two conductive pads.

11. A carrier for a surface mount differential and common mode filter as recited in claim 9, wherein said at least two apertures are adapted to receive electrical conductors disposed through said at least two apertures, wherein said conductive plating within said at least two apertures electrically connects said electrical conductors to said at least two conductive pads.

12. A carrier for a surface mount differential and common mode filter as recited in claim 9, wherein said conductive ground surface partially covers a first side of said planar insulator.

13. A carrier for a surface mount differential and common mode filter as recited in claim 12, wherein said conductive ground surface extends from said first side of said planar insulator onto the outer edge of said planar insulator.

14. A carrier for a surface mount differential and common mode filter as recited in claim 9, wherein said conductive ground surface partially covers a first and second side of said planar insulator.

15. A carrier for a surface mount differential and common mode filter as recited in claim 14, wherein said conductive ground surface extends from said first and second sides of said planar insulator onto the outer edge of said planar insulator.

16. A carrier for a surface mount differential and common mode filter as recited in claim 9, wherein said conductive ground surface is embedded within said planar insulator.

17. A carrier for a surface mount differential and common mode filter as recited in claim 12, further comprising a conductive ground surface embedded within said planar insulator and electrically connected to said conductive ground surface partially covering said first side of said planar insulator.

18. A carrier for a surface mount differential and common mode filter as recited in claim 14, further comprising a conductive ground surface embedded within said planar insulator and electrically connected to said conductive ground surface partially covering said first and second sides of said planar insulator.

19. A carrier for a surface mount differential and common mode filter as recited in claim 9, further comprising at least two conductive pads formed on a second side of said planar insulator to receive a second differential and common mode filter.

20. A carrier for a surface mount differential and common mode filter as recited in claim 19, wherein said at least two conductive pads are electrically connected to said conductive plating of said at least two apertures, thereby electrically connecting corresponding conductive pads on said first and second sides of said planar insulator.

21. A carrier for a surface mount differential and common mode filter as recited in claim 9, wherein said surface mount differential and common mode filter is configured with multiple first and second electrode bands and multiple common ground conductive bands, further comprising:

conductive traces disposed on said first side of said planar insulator and extending from said conductive pads in a predetermined pattern to electrically connect to said corresponding multiple first and second electrode bands; and

wherein said conductive ground surface partially covers said first side of said planar insulator in a predetermined pattern to electrically connect to said corresponding multiple common ground conductive bands.

22. A carrier for a surface mount differential and common mode filter as recited in claim 21, wherein said carrier includes conductive traces disposed on said second side of said planar insulator in an similar arrangement to allow said carrier to receive at least two surface mount differential and common mode filters.

23. A carrier for a surface mount differential and common mode filter as recited in claim 9, wherein said carrier is configured to receive multiple surface mount differential and common mode filters, further comprising:

conductive traces disposed on said first side of said planar insulator and extending from said conductive pads in a predetermined pattern to electrically connect to each of said first and second electrode bands of said multiple surface mount differential and common mode filters; and

wherein said conductive ground surface partially covers said first side of said planar insulator in a predetermined pattern to electrically connect to each of said corresponding multiple common ground conductive bands of said multiple surface mount differential and common mode filters.

24. A carrier for a surface mount differential and common mode filter as recited in claim 23, wherein said carrier includes conductive traces disposed on said second side of

said planar insulator in an similar arrangement to allow said carrier to receive at least two surface mount differential and common mode filters.

25. A thru-hole multi-conductor carrier for a plurality of surface mount differential and common mode filters, wherein each of said plurality of surface mount differential and common mode filters includes first and second electrode bands and at least one common ground conductive band, comprising:

a planar insulator having a plurality of apertures disposed therein;

a conductive ground surface partially spanning the area of said planar insulator;

a plurality of conductive pads formed on a first side of said planar insulator, wherein each of said plurality of apertures is surrounded by one of said plurality of conductive pads;

a plurality of insulating bands disposed on said planar insulator, wherein each of said plurality of conductive pads is electrically isolated from said conductive ground surface by one of said plurality of insulating bands; and

a plurality of conductive vias formed on a first side of said planar insulator, wherein each of said plurality of conductive vias is electrically connected to said conductive ground surface;

wherein said plurality of surface mount differential and common mode filters are placed upon said thru-hole multi-conductor carrier so that for each of said plurality of surface mount differential and common mode filters said first and second electrode bands of are electrically connected between at least two of said plurality of conductive pads and said common ground conductive band is electrically connected to said conductive ground surface.

26. A thru-hole multi-conductor carrier for a plurality of surface mount differential and common mode filters as recited in claim 25, wherein said conductive surface is embedded within said planar insulator.

27. A thru-hole multi-conductor carrier for a plurality of surface mount differential and common mode filters as recited in claim 26, further comprising a peripheral conductive surface disposed on the sides of said thru-hole multi-conductor carrier, wherein

said peripheral conductive surface is electrically connected to said embedded conductive surface.

28. A thru-hole multi-conductor carrier for a differential and common mode strip filter, wherein said differential and common mode strip filter includes a plurality of first and second electrode bands and a plurality of common ground conductive bands, comprising:

a planar insulator having a plurality of apertures disposed therein;

a conductive ground surface partially spanning the area of said planar insulator;

a plurality of conductive feed-thru apertures formed on a first side of said planar insulator, wherein each of said plurality of conductive feed-thru apertures is electrically connected to a conductive track disposed on said first side of said planar insulator; and

an insulating pattern disposed on said planar insulator, wherein each of said plurality of conductive feed-thru apertures and said conductive tracks are electrically isolated from one another and from said conductive ground surface; and

a predetermined conductive track pattern which is disposed on a first side of said planar insulator with members extending towards the center of said planar insulator, wherein said predetermined conductive track pattern is electrically connected to said conductive ground surface;

wherein said differential and common mode strip filter is placed upon said thru-hole multi-conductor carrier so that each of said first and second electrode bands are electrically connected between at least two of said plurality of said feed-thru apertures through said associated conductive track and said common ground conductive bands are electrically connected to said extended members of said predetermined conductive track pattern.

29. A thru-hole multi-conductor carrier for a differential and common mode strip filter as recited in claim 28, wherein said conductive ground surface partially covers the top, bottom and sides of said planar insulator.

30. A thru-hole multi-conductor carrier for a differential and common mode strip filter as recited in claim 28, wherein said conductive ground surface is embedded within said

planar insulator and electrically connected to said predetermined conductive track pattern through conductive vias.

31. A multi-component surface mount differential and common mode filter carrier, wherein each of said surface mount differential and common mode filters includes first and second electrode bands and at least one common ground conductive band, for connecting external circuitry to said plurality of surface mount differential and common mode filters comprising:

a planar insulator;

a conductive ground surface partially spanning the area of said planar insulator and disposed on a first side of said planar insulator;

a plurality of conductive surfaces disposed on said first side of said planar insulator having a plurality of apertures disposed therein; and

a predetermined pattern of insulating material disposed on said first side of said planar insulator which electrically isolates each of said plurality of conductive surfaces from one another and from said conductive ground surface;

wherein said predetermined pattern of insulating material separates pairs of said plurality of conductive surfaces with a portion of said conductive ground surface disposed between said pairs of said conductive surfaces;

wherein each surface mount differential and common mode filter is placed upon said pair of said conductive surfaces so that said first electrode band is electrically connected to one of said pair of conductive surfaces, said second electrode band is electrically connected to the other of said pair of conductive surfaces and said common ground conductive band is electrically connected to said conductive ground surface; and

wherein said external circuitry is electrically connected to said plurality of surface mount differential and common mode filters through said apertures disposed within each of said plurality of conductive surfaces.

32. A multi-component surface mount differential and common mode filter carrier as recited in claim 31, further comprising:

a conductive ground surface partially spanning the area of said planar insulator and disposed on a second side of said planar insulator;

a plurality of conductive surfaces disposed on said second side of said planar insulator having a plurality of apertures disposed therein; and

a predetermined pattern of insulating material disposed on said second side of said planar insulator which electrically isolates each of said plurality of conductive surfaces from one another and from said conductive ground surface;

wherein said predetermined pattern of insulating material separates pairs of said plurality of conductive surfaces with a portion of said conductive ground surface disposed between said pairs of said conductive surfaces;

wherein each surface mount differential and common mode filter is placed upon said pair of said conductive surfaces so that said first electrode band is electrically connected to one of said pair of conductive surfaces, said second electrode band is electrically connected to the other of said pair of conductive surfaces and said common ground conductive band is electrically connected to said conductive ground surface; and

wherein said external circuitry is electrically connected to said plurality of surface mount differential and common mode filters through said apertures disposed within each of said plurality of conductive surfaces.

33. A strain relief carrier for a differential and common mode filter, wherein said differential and common mode filter includes first and second electrodes and at least one common ground conductive electrode, comprising:

a rectangular conductive frame having a recessed ledge;

wherein said differential and common mode filter is received within said rectangular conductive frame and supported upon said recessed ledge; and

wherein said at least one common ground conductive electrode of said differential and common mode filter electrically connects through physical contact with said rectangular conductive frame.

34. A strain relief carrier for a differential and common mode filter as recited in

claim 33 wherein said rectangular conductive frame includes a plurality of outwardly extending members formed along all four sides of said rectangular conductive frame.

35. A strain relief carrier for a differential and common mode filter as recited in claim 34, further including a rectangular socket having a recessed ledge, wherein said rectangular socket receives said strain relief carrier and wherein said outwardly extending members of said rectangular conductive frame come in contact with said rectangular socket thereby maintaining said strain relief carrier and differential and common mode filter within said rectangular socket.

36. A ground strap carrier for a surface mount differential and common mode filter, wherein said surface mount differential and common mode filter includes first and second electrode bands and at least one common ground conductive band, used to mount said surface mount differential and common mode filter to the conductive housing of an electrical motor, comprising:

a base having an upwardly extending outer protuberance and an upwardly extending inner protuberance;

a vertical member extending upward from said inner protuberance;

a top extending from the distal end of said vertical member, said top extending in a horizontal direction opposite the direction of said base; and

a vertical member extending downward from the distal end of said top;

wherein the upper portion of said upwardly extending vertical member, said top and said downwardly extending vertical member form an inverted U-shaped hook for hanging said ground strap carrier from said conductive housing of said electrical motor;

wherein said base and said outer and inner protuberances form a U-shaped cradle for receiving said surface mount differential and common mode filter;

wherein said outer and inner protuberances physically contact and provide electrical connection between said ground strap carrier and said at least one common ground conductive band.

37. A ground strap carrier for a surface mount differential and common mode filter as recited in claim 36 further comprising:

at least two conductive springs electrically connected to brushes of said electrical motor wherein each of said at least two conductive springs comes in contact with and electrically connects to said first and second electrode bands in order to electrically connect said surface mount differential and common mode filter to said electrical motor.

38. A carrier for at least one surface mount differential and common mode filter, wherein said surface mount differential and common mode filter includes first and second electrode bands and at least one common ground conductive band, and wherein said carrier will be mounted to the top of a metal housing of an electrical motor with the rotor of said electrical motor passing through said carrier and the brushes of said electrical motor electrically connected to said first and second electrode bands and said at least one common ground conductive band, comprising:

a planar insulator having an insulated aperture disposed within the center of said planar insulator for receiving said rotor;

a conductive ground surface partially spanning a first side of said planar insulator;

at least three conductive tracks formed in a predetermined pattern on said first side of said planar insulator each electrically isolated from one another by insulation material;

wherein one of said at least three conductive tracks is electrically connected to said conductive ground surface; and

wherein said surface mount differential and common mode filter is placed upon said predetermined pattern of said at least three conductive tracks so that said common ground conductive band is electrically connected to said one of said at least three conductive tracks electrically connected to said conductive ground surface and said first and second electrode bands are electrically connected to said two remaining conductive tracks.

39. A carrier for at least one surface mount differential and common mode filter as recited in claim 38, further comprising a three pin electrical connector physically attached to said carrier and having each of said three pins electrically connected to one of said at least

three conductive tracks.

40. A carrier for at least one surface mount differential and common mode filter as recited in claim 39, wherein said brushes of said electrical motor are electrically connected to each of said at least three conductive tracks thereby electrically connecting each of said brushes to either said first and second electrode bands or said common ground conductive band of said surface mount differential and common mode filter.

41. A carrier for at least one surface mount differential and common mode filter as recited in claim 38, further comprising:

a conductive ground surface partially spanning a second side of said planar insulator;

at least three conductive tracks formed in a predetermined pattern on said second side of said planar insulator each electrically isolated from one another by insulation material;

wherein one of said at least three conductive tracks is electrically connected to said conductive ground surface; and

wherein said surface mount differential and common mode filter is placed upon said predetermined pattern of said at least three conductive tracks so that said common ground conductive band is electrically connected to said one of said at least three conductive tracks electrically connected to said conductive ground surface and said first and second electrode bands are electrically connected to said two remaining conductive tracks.

42. A carrier for at least one surface mount differential and common mode filter as recited in claim 41, wherein each of said three pins of said electrical connector are electrically connected to one of said at least three conductive tracks disposed on said second side of said planar insulator.

43. A carrier for at least one surface mount differential and common mode filter, wherein said surface mount differential and common mode filter includes first and second electrode bands and at least one common ground conductive band, and wherein said carrier will be mounted to the top of a metal housing of an electrical motor with the rotor of said

electrical motor passing through said carrier and the brushes of said electrical motor electrically connected to said first and second electrode bands and said at least one common ground conductive band, comprising:

a planar insulator having an insulated aperture disposed within the center of said planar insulator for receiving said rotor;

a conductive ground surface embedded within and partially spanning the area of said planar insulator;

at least three conductive tracks formed in a predetermined pattern on said first side of said planar insulator each electrically isolated from one another by insulation material;

wherein one of said at least three conductive tracks is electrically connected to said conductive ground surface; and

wherein said surface mount differential and common mode filter is placed upon said predetermined pattern of said at least three conductive tracks so that said common ground conductive band is electrically connected to said one of said at least three conductive tracks electrically connected to said conductive ground surface and said first and second electrode bands are electrically connected to said two remaining conductive tracks.

44. A carrier for at least one surface mount differential and common mode filter as recited in claim 43, further comprising a three pin electrical connector physically attached to said carrier and having each of said three pins electrically connected to one of said at least three conductive tracks.

45. A carrier for at least one surface mount differential and common mode filter as recited in claim 44, wherein said brushes of said electrical motor are electrically connected to each of said at least three conductive tracks thereby electrically connecting each of said brushes to either said first and second electrode bands or said common ground conductive band of said surface mount differential and common mode filter.

46. A carrier for at least one surface mount differential and common mode filter, wherein said surface mount differential and common mode filter includes first and second

electrode bands and at least one common ground conductive band, and wherein said carrier will be mounted to the top of a metal housing of an electrical motor with the rotor of said electrical motor passing through said carrier and the brushes of said electrical motor electrically connected to said first and second electrode bands and said at least one common ground conductive band, comprising:

a planar insulator having an insulated aperture disposed within the center of said planar insulator for receiving said rotor;

a conductive ground surface partially spanning a first side of said planar insulator;

at least three conductive tracks formed in a predetermined pattern and embedded within said planar insulator each electrically isolated from one another by insulation material;

wherein one of said at least three conductive tracks is electrically connected to said conductive ground surface; and

wherein said surface mount differential and common mode filter is placed upon said predetermined pattern of said at least three conductive tracks, and embedded within said planar insulator, so that said common ground conductive band is electrically connected to said one of said at least three conductive tracks electrically connected to said conductive ground surface and said first and second electrode bands are electrically connected to said two remaining conductive tracks.

47. A carrier for at least one surface mount differential and common mode filter as recited in claim 46, further comprising a three pin electrical connector physically attached to said carrier and having each of said three pins electrically connected to one of said at least three conductive tracks.

48. A carrier for at least one surface mount differential and common mode filter as recited in claim 47, wherein said brushes of said electrical motor are electrically connected to each of said at least three conductive tracks thereby electrically connecting each of said brushes to either said first and second electrode bands or said common ground conductive band of said surface mount differential and common mode filter.